PATENT ABSTRACTS OF JAPAN

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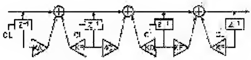
(54) OPTICAL DISK DRIVE DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To simplify a design and to unnecessitate a microcomputer for storing coeffts. so as to reduce the scale of hardware and the cost by changing a clock signal frequency to be supplied to digital filters in response to a linear velocity in an optical disk reading-out position.

SOLUTION: The digital filters are connected in three-stage series, and a frequency-divided clock signal CL is supplied to individual delay circuits Z-1. The coeffts. KA-KF are set to be optimum coeffts at the linear velocity V as an arbitrary velocity from a min. to a max., and these coeffts are always constant even at the time of changing the linear velocity V. On the contrary, the clock signal frequency is changed in response to the linear velocity V in the optical disk reading-out position. Provided the clock signal frequency at the time of the max. linear velocity V is a max. frequency in its processible range, whenever the linear velocity V becomes half, the clock signal frequency is also halved. Thus, an effect equivalent to the coeffts. KA-KF changed substantially in response to the linear velocity V is obtained.



DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the optical disk drive device which controls the tracking servo using a digital filter in an optical disk unit. As an optical disc, there are a compact disc (CD), CD-ROM, a laser disc, a digital versatile disc (DVD), etc.
[0002]
[Description of the Prior Art]Although the tracking error signal was processed in analog and the optical pickup was conventionally controlled as a tracking servo circuit of an optical disk unit, what is controlled using a digital filter has recently been used. Drawing 1 is a block diagram showing the conventional optical disk drive device which uses a digital filter. The RF amplifier which amplifies the data and the error signal in which 1 was read by the optical pickup and 2 was read by the optical pickup in the figure, The digital disposal circuit where 3 carries out digital signal processing of the data amplified by RF amplifier 2, The LPF/AD unit which consists of a low pass filter (LPF) for 4 to restrict the zone of the error signal amplified by RF amplifier 2, and an A/D converter which changes the output into a digital signal, As for the digital filter which 5 carries out data processing of the output of the LPF/AD unit 4, and acquires desired filter property, the D/A converter from which 6 changes the output of the digital filter 5 into an analog signal, and 7, a driver and 8 are drive coils.
[0003]In operation, the optical pickup 1 reads the error signal which is a difference of the access position to an optical disc, and the pit position of an optical disc while reading data in an optical disc (not shown). The high frequency component of the read data is amplified by RF amplifier 2, and processing treatment of it is carried out by the digital disposal circuit 3, and it is outputted. An error signal is amplified by RF amplifier 2, has the low-pass ingredient taken out by the LPF/AD unit 4, and is changed into a digital signal.It is changed into an analog signal by D/A converter 6, the driver 7 is supplied, the drive coil 8 is controlled by the output signal of the driver 7, and the digital signal makes the light spot from the optical pickup 1 follow in footsteps of the pit on an optical disc. The oscillating circuit 9 supplies a clock signal to the LPF/AD unit 4, the digital filter 5, and D/A converter 6.
[0004]A CAV (constant angular velocity) method and a CLV (linear velocity regularity) method are

one of the methods which rotate an optical disc. If an optical disc is rotated with CAV, the linear velocity of the optical disc at the time of reading of the data by the side of the periphery of an optical disc will be about 2.5 times the linear velocity of the optical disc at the time of reading of the data by the side of inner circumference. The frequency band to deal with must be made large, so that linear velocity becomes large. Therefore, it is difficult to acquire the frequency characteristic of the request from the error signal of both by the side of a periphery and inner circumference by the coefficient of the one digital filter 5 being immobilization.

[0005]There is a thing which rotates an optical disc by 1X, for example at the time of music reproduction, and makes it rotate at high speeds, such as twice, 4 times, 8 times, and 16 times, at the time of reading of data in the latest optical disk unit. In this case, it cannot respond that the coefficient of the one digital filter 5 is immobilization to a high velocity revolution. Conventionally the coefficient corresponding to the linear velocity at the time of reading of an optical disc is defined beforehand, it stores in the memory in the microcomputer 10, the coefficient corresponding to the linear velocity V outputted from the digital disposal circuit 3 was transmitted to the digital filter 5, and the coefficient corresponding to linear velocity was set up.

[0006]

[Problem(s) to be Solved by the Invention]However, the kind of large number corresponding to linear velocity as a coefficient of the digital filter 5, Whenever the frequency characteristic of an optical pickup and other components and the phase characteristic differed from gain characteristics etc., there was a problem that the work beforehand prepared with a simulation in the design stage of an optical disk unit was complicated.

[0007]As data in which the coefficient stored in the microcomputer 10 is shown, 2 bytes per coefficient of the digital filter 5 of data was required, and since data volume increased in proportion to the number of the coefficients of the digital filter 5, there was also a problem that the memory space of the microcomputer 10 increased. Based on the conception of changing the frequency of the clock signal supplied to a digital filter in view of the problem in the above-mentioned conventional technology according to the linear velocity in the read position of an optical disc, the purpose of this invention, While simplifying a design, using setting out of much combination of the digital filter in a design stage as unnecessary, it is shown in aiming at reduction of hardware scales, and reduction of cost, using as unnecessary the microcomputer which stores a coefficient.

[0008]

[Means for Solving the Problem]In order to attain the above-mentioned purpose, what is provided by this invention, It is an optical disk drive device having further dividing and a switching circuit to which frequency of an A/D converter, a digital filter, and a clock signal supplied to a D/A converter is changed according to linear velocity in a read position of an optical disc.

[0009]

[Embodiment of the Invention]Drawing 2 is a block diagram showing the optical disk drive device by 1 embodiment of this invention. In the figure, the same reference number is given to the conventional example and identical parts of drawing 1. if it explains again -- 1 -- an optical pickup and 2 -- an RF

amplifier and 3 -- as for a D/A converter and 7, a LPF/AD unit and 5 are [a drive coil and 9] oscillating circuits a driver and 8 a digital filter and 6 a digital disposal circuit and 4.

[0010]Dividing and the switching circuit 11 are formed by the embodiment of the invention. In operation, as usual, the optical pickup 1 reads the error signal which is a difference of the access position to an optical disc, and the pit position of an optical disc while reading data in an optical disc (not shown). The high frequency component of the read data is amplified by RF amplifier 2, and processing treatment of it is carried out by the digital disposal circuit 3, and it is outputted. An error signal is amplified by RF amplifier 2, has the low-pass ingredient taken out by the LPF/AD unit 4, and is changed into a digital signal. It is changed into an analog signal by D/A converter 6, the driver 7 is supplied, the drive coil 8 is controlled by the output signal of the driver 7, and the digital signal makes the light spot from the optical pickup 1 follow in footsteps of the pit on an optical disc.

[0011]The oscillating circuit 9 outputs the clock signal of the maximum frequency which the digital filter 5 can process. According to this embodiment, a clock signal with a frequency of 176.4 kHz is outputted. Dividing and the switching circuit 11 carry out dividing of the maximum frequency according to the linear velocity V outputted from the digital disposal circuit 3. Clock signal CL by which dividing was carried out is supplied to the LPF/AD unit 4, the digital filter 5, and D/A converter 6.

[0012]Drawing 3 shows an example of the circuitry of the digital filter 5. In this example, three steps of digital filters are connected in series. Clock signal CL by which dividing was carried out is supplied to each delay circuit Z^{-1}. charge several -- kA-KF is set up in this invention as an optimum coefficient [in / in the linear velocity V / the arbitrary speed of the minimum to the highest], and these coefficients are constant irrespective of change of linear velocity respectively. On the other hand, the frequency of a clock signal changes according to the linear velocity V in the read position of an optical disc. For example, when the linear velocity in the read position of an optical disc changes with 16 times at the time of music reproduction, 8 times, 4 times, twice, and 1 time, the relation between the linear velocity and the frequency of clock signal CL supplied to delay circuit Z^{-1} is as follows.

[0013]

[of twice / of / of 16 times as many .... / as / 176.4 kHz / 8 times / as many .... / as / 88.2 kHz / 4 times / as many .... / as / 44.1 kHz / as many .... / as this / 22.05 kHz / 1 time] as many .... [as] 11.025 kHz -- that is, As frequency of a clock signal in case linear velocity is the highest, maximum frequency within the limits which can process the digital filter 5 is used, and whenever linear velocity becomes half, it uses half [of the frequency of a clock signal]. it being alike and corresponding to linear velocity more nearly substantially, if it does in this way -- charge several [of the digital filter 5] -- an effect equivalent to having changed kA-KF is acquired.

[0014]Although 16X was made into top speed in the above-mentioned example, What is necessary is for top speed to make frequency of the clock signal at that time the maximum frequency within the limits which can process the digital filter 5 generally also in the case of n double speed at the time of music reproduction (n is a positive integer), and just to use half [of the frequency of a clock signal], whenever linear velocity becomes half. Drawing 4 is the graph which acquired the frequency

characteristic of the digital filter 5 in case frequency f_s of clock signal CL is 176.4 kHz with the simulation. As shown in a figure, gain-characteristics [in this case] G and the cut off frequency in the phase characteristic P are about 45 kHz.
[0015]Drawing 5 is the graph which acquired with the simulation the frequency characteristic of the digital filter 5 in case frequency f_s of clock signal CL is 88.2 kHz of the half which is 176.4 kHz. As shown in a figure, gain-characteristics [in this case] G and the cut off frequency in the phase characteristic P are about 22.4 kHz in the abbreviation half in the case of drawing 4. Thus, by making a clock frequency into a half shows that a frequency band is made in half. This shows that an effect equivalent to having changed the coefficient of the digital filter 5 is acquired by changing a clock frequency.
[0016]As explained above, from the filter property at the time of music reproduction to filter property in case linear velocity is n double speed can be easily acquired by changing the frequency of the clock signal impressed to a digital filter according to the linear velocity in the read position of an optical disc.

[0017]
[Effect of the Invention]While control of a digital filter becomes easy at the time of movement on a periphery from the inner circumference of an optical disc, and change of a double-speed ratio according to this invention, Since setting out of much combination of the digital filter in a design stage becomes unnecessary, while a design is simplified, the microcomputer which stores a coefficient becomes unnecessary, hardware scales are reduced, and cost is reduced. The fine control according to the revolving speed of the optical disc is attained to a digital filter.

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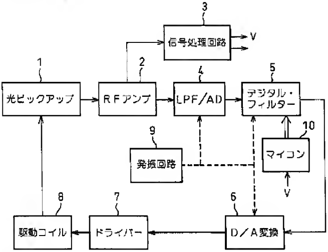
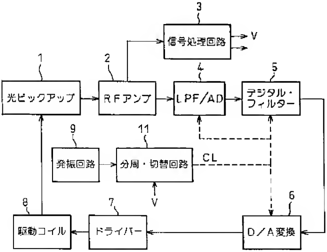
DRAWINGS

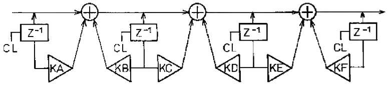
[Drawing 1]



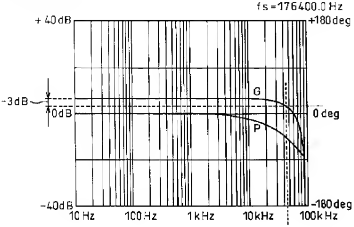
[Drawing 2]



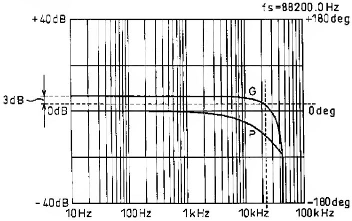
[Drawing 3]



[Drawing 4]



[Drawing 5]



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